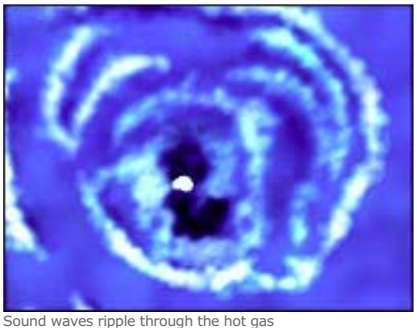
Black hole hums B flat

By Dr David Whitehouse
BBC News Online science editor

Astronomers have detected sound waves from a super-massive black hole. The "note" is the deepest ever detected from an object in the Universe.


Sound waves ripple through the hot gas

The black hole lives in the Perseus cluster of galaxies, located 250 million light-years away.

The tremendous amounts of energy carried from the black hole by these sound waves may solve a longstanding problem in astrophysics.

The pitch of the sound can be determined. Although far too low to be heard, it is calculated to be B flat.

Beyond hearing

Last year astronomers obtained an image from the orbiting Chandra X-ray telescope showing ripples in the gas filling the Perseus galactic cluster.

According to the researchers the ripples are evidence for sound waves that have travelled hundreds of thousands of light years from the cluster's central black hole.

In musical terms, the pitch of the sound generated by the black hole translates into the note of B flat.

But a human would have no chance of hearing it because the note is 57 octaves lower than middle-C.

With a frequency over a million, billion times deeper than the limits of human hearing, it is the deepest note ever detected from an object in the Universe.

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"The Perseus sound waves are much more than just an interesting form of black hole acoustics," says Steve Allen of the Institute of Astronomy in Cambridge, England.


X-rays from the Perseus cluster

"These sound waves may be the key in figuring out how galaxy clusters, the largest structures in the Universe, grow."

Sustained note

Astronomers are puzzled because there is so much hot gas in galaxy clusters and so little cool gas. The hot gas should cool, and the dense central gas should cool the fastest.

Then the pressure in this cool central gas should fall, causing gas further out to sink in towards the galaxy, forming trillions of stars along the way. But this is not what is seen.

Heating caused by a central black hole has long been considered a good way to prevent cluster gas from cooling.

Previous Chandra observations of the Perseus cluster showed two vast, bubble-shaped cavities in the cluster gas extending away from the central black hole.

Sound waves spreading out from the cavities could provide the much sought after heating mechanism.

Researchers calculate that a tremendous amount of energy is needed to generate the cavities, as much as the combined energy from 100 million exploding stars.

Much of this energy could be carried by the sound waves that should keep the gas warm. If so, the B-flat pitch of the sound wave, 57 octaves below middle-C, would have remained roughly constant for about 2.5 billion years.

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